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Heat exchanger, particularly exhaust heat exchanger

The invention relates to a heat exchanger for cooling gaseous or liquid media, particularly an exhaust heat exchanger for an internal combustion engine, with a tubular housing which has at least one inlet opening with an adjoining annular duct for the distributed flow of a cooling medium into the interior of the housing.

A heat exchanger of this type is known from DE 102 38 882 A1 and comprises a tubular housing, in which a nest of tubes is inserted for the exhaust gas to flow through axially, introduced coolant washing around the nest of tubes. As a consequence of the tubes, on the one hand, and the housing, on the other hand, being subjected to different temperatures, during operation of the exhaust heat exchanger thermal stresses arise due to different expansions of the tubes and of the housing. To compensate for stresses of this type, slots are arranged in the housing and are sealed to the outside by a duct housing with a corrugated tube section. This gives rise to an expansion compensating element which is integrated in the heat exchanger housing.

The coolant is fed into the housing interior via an inlet opening introduced radially into the housing, and an annular duct which follows downstream and through which a uniform distribution of the coolant flowing into the housing interior is to take place.

The annular duct, which is situated within the housing, has an adverse effect on the cross section through which the flow can pass, and on the production of the heat exchanger. In addition, it is also not yet possible for the annular duct on its own to achieve a

circumferential distribution of the coolant that is as uniform as possible over the housing interior and a largely uniform flow rate of the coolant in the interior of the housing.

Furthermore, DE 296 12 361 U1 discloses a further heat exchanger with an expansion compensating element which is integrated in the heat exchanger housing, which is composed of sheet metal.

The invention is based on the object of developing the heat exchanger of the generic type in such a manner that, with a simplified design, a uniform flow, which is distributed over the circumference of the housing, of coolant into the housing interior can reliably take place.

According to the invention, the object is achieved by the features indicated in the characterizing part of patent claim 1.

The effect achieved by the arrangement according to the invention of the annular duct on the outside of the housing is that the housing interior is no longer adversely affected in terms of construction space by the annular duct.

Furthermore, it is possible, by means of a simple distribution of passage openings in the housing, to obtain a uniform flow, which is distributed over the circumference thereof, of coolant into the housing interior.

In a further refinement of the invention, it is advantageous if the inlet opening is arranged on the duct housing and has a connecting branch for a hose line.

Simple production is achieved if the heat exchanger housing and the duct housing are produced from one piece, for example by casting. Irrespective of this, it is also conceivable, however, to produce the duct housing separately from the heat exchanger housing, for example from sheet metal, and to connect it tightly thereto by welding or soldering.

In a refinement of the heat exchanger with a duct housing made from sheet metal, it is furthermore advantageous within the scope of the invention if parts of the heat exchanger housing and the duct housing are used at the same time in order to form an expansion element which is customary in the case of heat exchangers of this type. This creates a heat exchanger which is constructed compactly and can be produced cost-effectively, since, for example, a special duct housing for distributing the coolant can be omitted.

This is achieved by the duct housing being designed with a corrugated tube section and the passage openings being designed as slots which extend partially over the circumference of the heat exchanger housing at an axial distance from one another. In the case of the heat exchanger created in this manner, the integrated expansion element at the same time takes on the function of uniform distribution of the coolant in the housing interior.

In order, as far as possible here, to be able to use the entire length of the heat exchanger housing for the cooling, the expansion element is arranged with the inlet opening at that end of the housing which is on the entry side, with a smooth, cylindrical part of the duct housing being welded or soldered to the heat exchanger housing, and the adjoining corrugated tube

section being welded or soldered to the flange on the entry side of the housing.

The invention is explained in more detail below with reference to an exemplary embodiment which is shown in the drawing.

The single drawing shows, in a perspective illustration, only the essential parts of a heat exchanger for cooling gaseous media.

The heat exchanger illustrated in the exemplary embodiment is an exhaust heat exchanger 1 for cooling the exhaust gases of an internal combustion engine, in particular for cooling the exhaust gases returned in certain operating states to the combustion space of the internal combustion engine (what is referred to as exhaust gas recirculation).

The exhaust heat exchanger 1 has a tubular housing 2 with respective flanges 3, 4 on the inflow side 5 and on the outflow side 6. The housing 2 is of U-shape design, and so the flanges 3 and 4 are situated laterally next to each other. The U-shaped housing parts are connected to one another by means of a tab 7. A sheet-metal hanger 8 is provided for fastening the heat exchanger 1 to the housing of the internal combustion engine.

It cannot be seen that a nest of tubes which extends in the longitudinal direction is arranged in the interior of the heat exchanger housing 2 and is welded tightly to the housing 2 via respective tube plates at the housing ends on the longitudinal sides.

This gives rise between the housing 2 and the nest of tubes to a coolant space for coolant for cooling the

exhaust gases flowing through the individual tubes of the nest of tubes itself.

In the region of the flange 3 situated on the inflow side 5, the housing 2 is on the outside by a duct housing 9 which encloses an annular duct 10 with respect to the housing 2. According to the exemplary embodiment, the duct housing 9 is composed of sheet metal and is connected to the heat exchanger housing 2 by welding or soldering. Within the scope of the invention, the duct housing 2 may also be composed of the same material as the housing 2 and may be formed as a single piece with it. The duct housing 2 has an inlet opening 11 with a connecting branch 12 for a coolant hose.

Passage openings 13 to 16 are distributed over the circumference of that part of the housing 2 which is covered by the duct housing 9. Via the passage openings 13 to 16, the coolant passed from the connecting branch 11 into the annular duct 10 can therefore flow in a uniformly distributed manner into the interior of the housing 2, so that, in addition to a largely uniform heating, also a largely uniform flow rate of the coolant along the surface of the tubes through which the exhaust gas flows is ensured. The discharge of the coolant from the housing 2 takes place in the vicinity of the flange 4 on the outflow side 6 through a connecting branch 17.

According to the exemplary embodiment, the duct housing 9 with the passage openings is part of an expansion element 18 integrated in the housing 2. So that, in addition to supplying coolant and distributing coolant, the duct housing 2 together with the passage openings 13 to 16 can carry out the function of compensating for expansion, the passage openings 13 to 16 are designed

as slots which are in each case arranged over part of the circumference at an axial distance from one another while the duct housing 9, which covers the slots to the outside and is composed of sheet metal, also has, in addition to a smooth, cylindrical housing section 19 for receiving the connecting branch 12, an additional corrugated tube section 20 for compensating for expansion.

So that, as far as possible, the entire length of the housing 2 can be used for the cooling, the connecting branches 12 and 17 are arranged tightly next to the flanges 3 and 4. This leads to the expansion element 17 being positioned tightly next to the flange 3, with the housing section 19 being welded or soldered directly to the housing 2, and the corrugated tube section 20 being welded or soldered directly to the flange 3. The duct housing 9 is protected against external influences by means of a protective covering 21.

According to the exemplary embodiment, the subject matter of the invention is illustrated in the combination of a heat exchanger with an expansion element. However, in addition to this embodiment, the invention also comprises an embodiment of a heat exchanger without an expansion element, in which the duct housing 2 is designed without the additional corrugated tube section 20 and the passage openings 13 to 16 are produced as simple holes.